

What is claimed is:

1. A plunger pump housing for use with a valve stem guide and spring retainer assembly, the plunger pump housing comprising:
 - a suction valve bore having a portion with substantially circular cross-sections for accommodating a circular suction valve, a cylindrical transition area, a shoulder corresponding to a suction valve top stem guide and spring retainer shoulder mating surface, and a first centerline;
 - a discharge valve bore having a portion with substantially circular cross-sections for accommodating a circular discharge valve, a cylindrical transition area, a shoulder corresponding to a discharge valve lower stem guide shoulder mating surface, and a second centerline, said first and second centerlines being colinear;
 - a cylinder bore having a proximal packing area and a distal transition area, said packing area having a substantially circular cross-section and a third centerline, said third centerline being coplanar with said first and second centerlines; and
 - an access bore having a cylindrical transition area with elongated cross-sections for facilitating access to interior portions of the plunger pump housing, and a fourth center line, said fourth centerline being colinear with said third center line;
- wherein said suction valve bore transition area has an elongated cross-section substantially perpendicular to said first centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;
- wherein said discharge valve bore transition area has an elongated cross-section substantially perpendicular to said second centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;
- wherein said cylinder bore transition area has elongated cross-sections substantially perpendicular to said third centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;
- wherein said access bore transition area has elongated cross-sections substantially perpendicular to said fourth centerline, each said elongated access bore cross-section having a long axis

28 substantially perpendicular to a plane containing said first, second, third and fourth
29 centerlines; and
30 wherein each said bore transition area has at least one adjacent chamfer for smoothing bore
31 interfaces.

1 2. The plunger pump housing of claim 1 wherein said second and third centerlines form an
2 angle within a range of approximately 85 degrees and approximately 95 degrees.

1 3. A valve stem guide and spring retainer assembly for use in the plunger pump housing of
2 claim 1, the assembly comprising
3 a discharge valve lower stem guide for placement substantially within a discharge bore
4 transition area of the plunger pump housing, said discharge valve lower stem
5 guide comprising a body having first and second ends and a transverse cross-
6 section, said first end comprising a shoulder mating surface for mating with a
7 corresponding shoulder within said discharge bore, and said second end
8 comprising at least one lateral alignment groove, a centered cylindrical guide stem
9 hole extending longitudinally between said first and second ends, and at least one
10 fluid passage extending longitudinally between said first and second ends;
11 a suction valve top stem guide and spring retainer for placement substantially opposite
12 said discharge valve lower stem guide and aligned with a suction bore transition
13 area of the plunger pump housing, said suction valve top stem guide and spring
14 retainer comprising a body having first and second ends and a transverse cross-
15 section, said first end comprising a shoulder mating surface for mating with a
16 corresponding shoulder within said suction bore, and said second end comprising
17 at least one lateral alignment groove for placement opposing said at least one
18 discharge valve lower stem guide alignment groove to form at least one opposing
19 lateral alignment groove pair, a centered cylindrical guide stem hole extending
20 longitudinally between said first and second ends, and at least one fluid passage
21 extending longitudinally between said first and second ends;

22 at least one side spacer having first and second parallel edges for insertion between
23 grooves of said at least one opposing lateral alignment groove pair, said first and
24 second parallel edges being spaced apart sufficiently to assure upon insertion
25 simultaneous mating between shoulder mating surfaces of said discharge valve
26 lower stem guide and said suction valve top stem guide and spring retainer and
27 corresponding pump housing shoulders when the valve stem guide and spring
28 retainer assembly is used in the plunger pump housing; and
29 wherein said discharge valve lower stem guide and said suction valve top stem guide and spring
30 retainer each have transverse cross-sections dimensioned to allow a close longitudinal
31 sliding fit within, respectively, a corresponding cylindrical discharge bore transition area
32 and a corresponding cylindrical suction bore transition area of the plunger pump housing.

1 4. The valve stem guide and spring retainer assembly of claim 3 comprising two lateral
2 alignment groove pairs and two side spacers.

1 5. The valve stem guide and spring retainer assembly of claim 4 additionally comprising an
2 access bore cover plug for covering said access bore and for spacing said two side spacers a
3 predetermined distance apart.

1 6. A plunger pump housing for use with a valve stem guide and spring retainer assembly,
2 the plunger pump housing comprising:
3 a suction valve bore having a portion with substantially circular cross-sections for
4 accommodating a circular suction valve, a cylindrical transition area, a shoulder
5 corresponding to a suction valve spring retainer shoulder mating surface, and a
6 first centerline;
7 a discharge valve bore having a portion with substantially circular cross-sections for
8 accommodating a circular discharge valve, a cylindrical transition area, a shoulder
9 corresponding to a discharge valve lower stem guide shoulder mating surface, and
10 a second centerline, said first and second centerlines being colinear;

11 a cylinder bore having a proximal packing area and a distal transition area, said packing
12 area having a substantially circular cross-section and a third centerline, said third
13 centerline being coplanar with said first and second centerlines; and
14 an access bore having a cylindrical transition area with elongated cross-sections for
15 facilitating access to interior portions of the plunger pump housing, and a fourth
16 center line, said fourth centerline being colinear with said third center line;
17 wherein said suction valve bore transition area has an elongated cross-section substantially
18 perpendicular to said first centerline and with a long axis substantially perpendicular to a
19 plane containing said first, second, third and fourth centerlines;
20 wherein said discharge valve bore transition area has an elongated cross-section substantially
21 perpendicular to said second centerline and with a long axis substantially perpendicular
22 to a plane containing said first, second, third and fourth centerlines;
23 wherein said cylinder bore transition area has elongated cross-sections substantially
24 perpendicular to said third centerline and with a long axis substantially perpendicular to
25 a plane containing said first, second, third and fourth centerlines;
26 wherein said access bore transition area has elongated cross-sections substantially perpendicular
27 to said fourth centerline, each said elongated access bore cross-section having a long axis
28 substantially perpendicular to a plane containing said first, second, third and fourth
29 centerlines; and
30 wherein each said bore transition area has at least one adjacent chamfer for smoothing bore
31 interfaces.

1 7. The plunger pump housing of claim 6 wherein said second and third centerlines form an
2 angle within a range of approximately 85 degrees and approximately 95 degrees.

1 8. A valve stem guide and spring retainer assembly for use in the plunger pump housing of
2 claim 6, the assembly comprising
3 a discharge valve lower stem guide for placement substantially within a discharge bore
4 transition area of the plunger pump housing, said discharge valve lower stem
5 guide comprising a body having first and second ends and a transverse cross-

section, said first end comprising a shoulder mating surface for mating with a corresponding shoulder within said discharge bore, and said second end comprising at least one lateral alignment groove, a centered cylindrical guide stem hole extending longitudinally between said first and second ends, and at least one fluid passage extending longitudinally between said first and second ends;

a suction valve spring retainer for placement substantially opposite said discharge valve lower stem guide and aligned with a suction bore transition area of the plunger pump housing, said suction valve spring retainer comprising a body having first and second ends and a transverse cross-section, said first end comprising a shoulder mating surface for mating with a corresponding shoulder within said suction bore, and said second end comprising at least one lateral alignment groove for placement opposing said at least one discharge valve lower stem guide alignment groove to form at least one opposing lateral alignment groove pair, and at least one fluid passage extending longitudinally between said first and second ends;

at least one side spacer having first and second parallel edges for insertion between grooves of said at least one opposing lateral alignment groove pair, said first and second parallel edges being spaced apart sufficiently to assure upon insertion simultaneous mating between shoulder mating surfaces of said discharge valve lower stem guide and said suction valve spring retainer and corresponding pump housing shoulders when the valve stem guide and spring retainer assembly is used in the plunger pump housing; and

wherein said discharge valve lower stem guide and said suction valve spring retainer each have transverse cross-sections dimensioned to allow a close longitudinal sliding fit within, respectively, a corresponding cylindrical discharge bore transition area and a corresponding cylindrical suction bore transition area of the plunger pump housing.

9. The valve stem guide and spring retainer assembly of claim 8 comprising two lateral alignment groove pairs and two side spacers.

10. The valve stem guide and spring retainer assembly of claim 9 additionally comprising an access bore cover plug for covering said access bore and for spacing said two side spacers a predetermined distance apart.

11. A plunger pump housing for use with a valve stem guide and spring retainer assembly, the plunger pump housing comprising:

a suction valve bore having a portion with substantially circular cross-sections for accommodating a circular suction valve, a transition area, and a first centerline; a discharge valve bore having a portion with substantially circular cross-sections for accommodating a circular discharge valve, a cylindrical transition area, a shoulder corresponding to a discharge valve lower stem guide mating surface, and a second centerline, said first and second centerlines being colinear;

a cylinder bore having a proximal packing area and a distal transition area, said packing area having a substantially circular cross-section and a third centerline, said third centerline being coplanar with said first and second centerlines; and

an access bore having a cylindrical transition area with elongated cross-sections for facilitating access to interior portions of the plunger pump housing, and a fourth center line, said fourth centerline being colinear with said third center line;

wherein said suction valve bore transition area has an elongated cross-section substantially perpendicular to said first centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;

wherein said discharge valve bore transition area has an elongated cross-section substantially perpendicular to said second centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;

wherein said cylinder bore transition area has elongated cross-sections substantially perpendicular to said third centerline and with a long axis substantially perpendicular to a plane containing said first, second, third and fourth centerlines;

wherein said access bore transition area has elongated cross-sections substantially perpendicular to said fourth centerline, each said elongated access bore cross-section having a long axis

substantially perpendicular to a plane containing said first, second, third and fourth centerlines; and wherein each said bore transition area has at least one adjacent chamfer for smoothing bore interfaces.

12. The plunger pump housing of claim 11 wherein said second and third centerlines form an angle within a range of approximately 85 degrees and approximately 95 degrees.

13. A valve stem guide and spring retainer assembly for use in the plunger pump housing of claim 11, the assembly comprising

a discharge valve lower stem guide for placement substantially within a discharge bore transition area of the plunger pump housing, said discharge valve lower stem guide comprising a body having first and second ends and a transverse cross-section, said first end comprising a shoulder mating surface for mating with a corresponding shoulder within said discharge bore, and said second end comprising at least one lateral alignment groove, a centered cylindrical guide stem hole extending longitudinally between said first and second ends, and at least one fluid passage extending longitudinally between said first and second ends;

a suction valve top stem guide and spring retainer for placement substantially opposite said discharge valve lower stem guide and aligned with a suction bore transition area of the plunger pump housing, said suction valve top stem guide and spring retainer comprising a body having first and second ends and a transverse cross-section, said first end comprising a chamfer mating surface for mating with a chamfer adjacent said suction bore, and said second end comprising at least one lateral alignment groove for placement opposing said at least one discharge valve lower stem guide alignment groove to form at least one opposing lateral alignment groove pair, a centered cylindrical guide stem hole extending longitudinally between said first and second ends, and at least one fluid passage extending longitudinally between said first and second ends;

22 at least one side spacer having first and second parallel edges for insertion between
23 grooves of said at least one opposing lateral alignment groove pair, said first and
24 second parallel edges being spaced apart sufficiently to assure upon insertion
25 mating between said shoulder mating surface of said discharge valve lower stem
26 guide and said corresponding pump housing shoulder, simultaneous with mating
27 between said suction valve top stem guide and spring retainer chamfer mating
28 surface and said corresponding chamfer adjacent said suction bore when the valve
29 stem guide and spring retainer assembly is used in the plunger pump housing; and
30 wherein said discharge valve lower stem guide and said suction valve top stem guide and spring
31 retainer each have transverse cross-sections dimensioned to allow a close longitudinal
32 sliding fit within, respectively, a corresponding cylindrical discharge bore transition area
33 and a corresponding cylindrical suction bore transition area of the plunger pump housing.

1 14. The valve stem guide and spring retainer assembly of claim 13 comprising two lateral
2 alignment groove pairs and two side spacers.

1 15. The valve stem guide and spring retainer assembly of claim 14 additionally comprising an
2 access bore cover plug for covering said access bore and for spacing said two side spacers a
3 predetermined distance apart.

1 16. A valve stem guide and spring retainer assembly for use in the plunger pump housing of
2 claim 11, the assembly comprising
3 a discharge valve lower stem guide for placement substantially within a discharge bore
4 transition area of the plunger pump housing, said discharge valve lower stem
5 guide comprising a body having first and second ends and a transverse cross-
6 section, said first end comprising a shoulder mating surface for mating with a
7 corresponding shoulder within said discharge bore, and said second end
8 comprising at least one lateral alignment groove, a centered cylindrical guide stem
9 hole extending longitudinally between said first and second ends, and at least one
10 fluid passage extending longitudinally between said first and second ends;

11 a suction valve spring retainer for placement substantially opposite said discharge valve
12 lower stem guide and aligned with a suction bore transition area of the plunger
13 pump housing, said suction valve spring retainer comprising a body having first
14 and second ends and a transverse cross-section, said first end comprising a
15 chamfer mating surface for mating with a chamfer adjacent said suction bore, and
16 said second end comprising at least one lateral alignment groove for placement
17 opposing said at least one discharge valve lower stem guide alignment groove to
18 form at least one opposing lateral alignment groove pair, and at least one fluid
19 passage extending longitudinally between said first and second ends;
20 at least one side spacer having first and second parallel edges for insertion between
21 grooves of said at least one opposing lateral alignment groove pair, said first and
22 second parallel edges being spaced apart sufficiently to assure upon insertion
23 mating between shoulder mating surface of said discharge valve lower stem guide
24 and said corresponding pump housing shoulder, simultaneous with mating
25 between said suction valve spring retainer chamfer mating surface and said
26 corresponding chamfer adjacent said suction bore when the valve stem guide and
27 spring retainer assembly is used in the plunger pump housing; and
28 wherein said discharge valve lower stem guide and said suction valve spring retainer each have
29 transverse cross-sections dimensioned to allow a close longitudinal sliding fit within,
30 respectively, a corresponding cylindrical discharge bore transition area and a
31 corresponding cylindrical suction bore transition area of the plunger pump housing.

1 17. The valve stem guide and spring retainer assembly of claim 16 comprising two lateral
2 alignment groove pairs and two side spacers.

1 18. The valve stem guide and spring retainer assembly of claim 17 additionally comprising an
2 access bore cover plug for covering said access bore and for spacing said two side spacers a
3 predetermined distance apart.

1 19. A plunger pump housing for use with a valve stem guide and spring retainer assembly,
2 the plunger pump housing comprising:

3 a suction valve bore having a portion with substantially circular cross-sections for
4 accommodating a circular suction valve, a cylindrical transition area, a shoulder
5 corresponding to a suction valve top stem guide and spring retainer shoulder
6 mating surface, and a first centerline;
7 a discharge valve bore having a portion with substantially circular cross-sections for
8 accommodating a circular discharge valve, a cylindrical transition area, a shoulder
9 corresponding to a discharge valve lower stem guide shoulder mating surface and
10 a second centerline, said first and second centerlines being colinear;
11 a cylinder bore having a proximal packing area and a distal transition area, said packing
12 area having a substantially circular cross-section and a third centerline, said third
13 centerline being coplanar with said first and second centerlines; and
14 an access bore having a cylindrical transition area with elongated cross-sections for
15 facilitating access to interior portions of the plunger pump housing, and a fourth
16 center line, said fourth centerline being colinear with said third center line;
17 wherein said cylinder bore transition area has elongated cross-sections substantially
18 perpendicular to said third centerline and with a long axis substantially perpendicular to
19 a plane containing said first, second, third and fourth centerlines;
20 wherein said access bore transition area has elongated cross-sections substantially perpendicular
21 to said fourth centerline, each said elongated access bore cross-sections having a long
22 axis substantially perpendicular to a plane containing said first, second, third and fourth
23 centerlines; and
24 wherein each said bore transition area has at least one adjacent chamfer for smoothing bore
25 interfaces..

1 20. The plunger pump housing of claim 19 wherein said second and third centerlines form an
2 angle within a range of approximately 85 degrees and approximately 95 degrees.

1 21. A valve stem guide and spring retainer assembly for use in the plunger pump housing of
2 claim 19, the assembly comprising

3 a discharge valve lower stem guide for placement substantially within a discharge bore
4 transition area of the plunger pump housing, said discharge valve lower stem
5 guide comprising a body having first and second ends and a transverse cross-
6 section, said first end comprising a shoulder mating surface for mating with a
7 corresponding shoulder within said discharge bore, and said second end
8 comprising at least one lateral alignment groove, a centered cylindrical guide stem
9 hole extending longitudinally between said first and second ends, and at least one
10 fluid passage extending longitudinally between said first and second ends;
11 a suction valve top stem guide and spring retainer for placement substantially opposite
12 said discharge valve lower stem guide and aligned with a suction bore transition
13 area of the plunger pump housing, said suction valve top stem guide and spring
14 retainer comprising a body having first and second ends and a transverse cross-
15 section, said first end comprising a shoulder mating surface for mating with a
16 corresponding shoulder within said suction bore, and said second end comprising
17 at least one lateral alignment groove for placement opposing said at least one
18 discharge valve lower stem guide alignment groove to form at least one opposing
19 lateral alignment groove pair, a centered cylindrical guide stem hole extending
20 longitudinally between said first and second ends, and at least one fluid passage
21 extending longitudinally between said first and second ends;
22 at least one side spacer having first and second parallel edges for insertion between
23 grooves of said at least one opposing lateral alignment groove pair, said first and
24 second parallel edges being spaced apart sufficiently to assure upon insertion
25 simultaneous mating between shoulder mating surfaces of said discharge valve
26 lower stem guide and said suction valve top stem guide and spring retainer and
27 corresponding pump housing shoulders when the valve stem guide and spring
28 retainer assembly is used in the plunger pump housing; and
29 wherein said discharge valve lower stem guide and said suction valve top stem guide and spring
30 retainer each have transverse cross-sections dimensioned to allow a close longitudinal
31 sliding fit within, respectively, a corresponding cylindrical discharge bore transition area
32 and a corresponding cylindrical suction bore transition area of the plunger pump housing.

22. The valve stem guide and spring retainer assembly of claim 21 comprising two lateral alignment groove pairs and two side spacers.

23. The valve stem guide and spring retainer assembly of claim 22 additionally comprising an access bore cover plug for covering said access bore and for spacing said two side spacers a predetermined distance apart.

24. A valve stem guide and spring retainer assembly for use in the plunger pump housing of claim 19, the assembly comprising

a discharge valve lower stem guide for placement substantially within a discharge bore transition area of the plunger pump housing, said discharge valve lower stem guide comprising a body having first and second ends and a transverse cross-section, said first end comprising a shoulder mating surface for mating with a corresponding shoulder within said discharge bore, and said second end comprising at least one lateral alignment groove, a centered cylindrical guide stem hole extending longitudinally between said first and second ends, and at least one fluid passage extending longitudinally between said first and second ends;

a suction valve spring retainer for placement substantially opposite said discharge valve lower stem guide and aligned with a suction bore transition area of the plunger pump housing, said suction valve spring retainer comprising a body having first and second ends and a transverse cross-section, said first end comprising a shoulder mating surface for mating with a corresponding shoulder within said suction bore, and said second end comprising at least one lateral alignment groove for placement opposing said at least one discharge valve lower stem guide alignment groove to form at least one opposing lateral alignment groove pair, and at least one fluid passage extending longitudinally between said first and second ends;

at least one side spacer having first and second parallel edges for insertion between grooves of said at least one opposing lateral alignment groove pair, said first and second parallel edges being spaced apart sufficiently to assure upon insertion

24 simultaneous mating between shoulder mating surfaces of said discharge valve
25 lower stem guide and said suction valve spring retainer and corresponding pump
26 housing shoulders when the valve stem guide and spring retainer assembly is used
27 in the plunger pump housing; and
28 wherein said discharge valve lower stem guide and said suction valve spring retainer each have
29 transverse cross-sections dimensioned to allow a close longitudinal sliding fit within,
30 respectively, a corresponding cylindrical discharge bore transition area and a
31 corresponding cylindrical suction bore transition area of the plunger pump housing.

1 25. The valve stem guide and spring retainer assembly of claim 24 comprising two lateral
2 alignment groove pairs and two side spacers.

1 26. The valve stem guide and spring retainer assembly of claim 25 wherein each said side
2 spacer is dimensioned to fit closely within said plunger pump housing and a plunger inserted for
3 use within said housing.

1 27. The valve stem guide and spring retainer assembly of claim 25 additionally comprising an
2 access bore cover plug for covering said access bore and for spacing said two side spacers a
3 predetermined distance apart.